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Forest Insect and Disease Conditions

Vancouver Forest Region
1986

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SUMMARY

This report outlines the status of forest pest conditions in the Vancouver Forest Region in 1986 and attempts to forecast population trends of some potentially damaging pests. Pests are listed by host in order of importance.

Mountain pine beetle killed an estimated 126 850 lodgepole pine over 4 160 ha in the Soo, Quadra and Fraser TSA's, a slight increase from 102 500 trees killed in 1985. **Pine engraver beetles** were abundant in trees partially attacked by mountain pine beetle in the Birkenhead Lake area. **Pine needle sheathminer** defoliated immature lodgepole pine over 302 ha in seven locations in the Region.

Western spruce budworm caused light to moderate defoliation of Douglas-fir over 1 255 ha in the D'Arcy and Blackwater Creek drainages, the first time since 1981. For the second consecutive year, **Douglas-fir beetle** attacks decreased to 55 ha. **Spruce beetle** killed an estimated 8 000 m^3 of Sitka spruce over 327 ha in the Smokehouse Creek drainage south of Rivers Inlet.

The **blackheaded budworm** infestation in the Statlu Creek drainage that lightly defoliated 2 000 ha of western hemlock in 1985 collapsed in 1986.

Balsam bark beetle killed high-elevation alpine fir over 240 ha, mainly in the Upper Fraser Canyon and Lillooet Lake areas, down from 380 ha in 1985.

The **western cedar borer** attacked semimature and mature cedar over 100 ha at North Bend.

Cooley spruce gall aphid was widespread and occurred throughout most of its host's range. **Abiotic damage**, attributed to drought and other climatic conditions, caused dieback and scattered mortality throughout the Region.

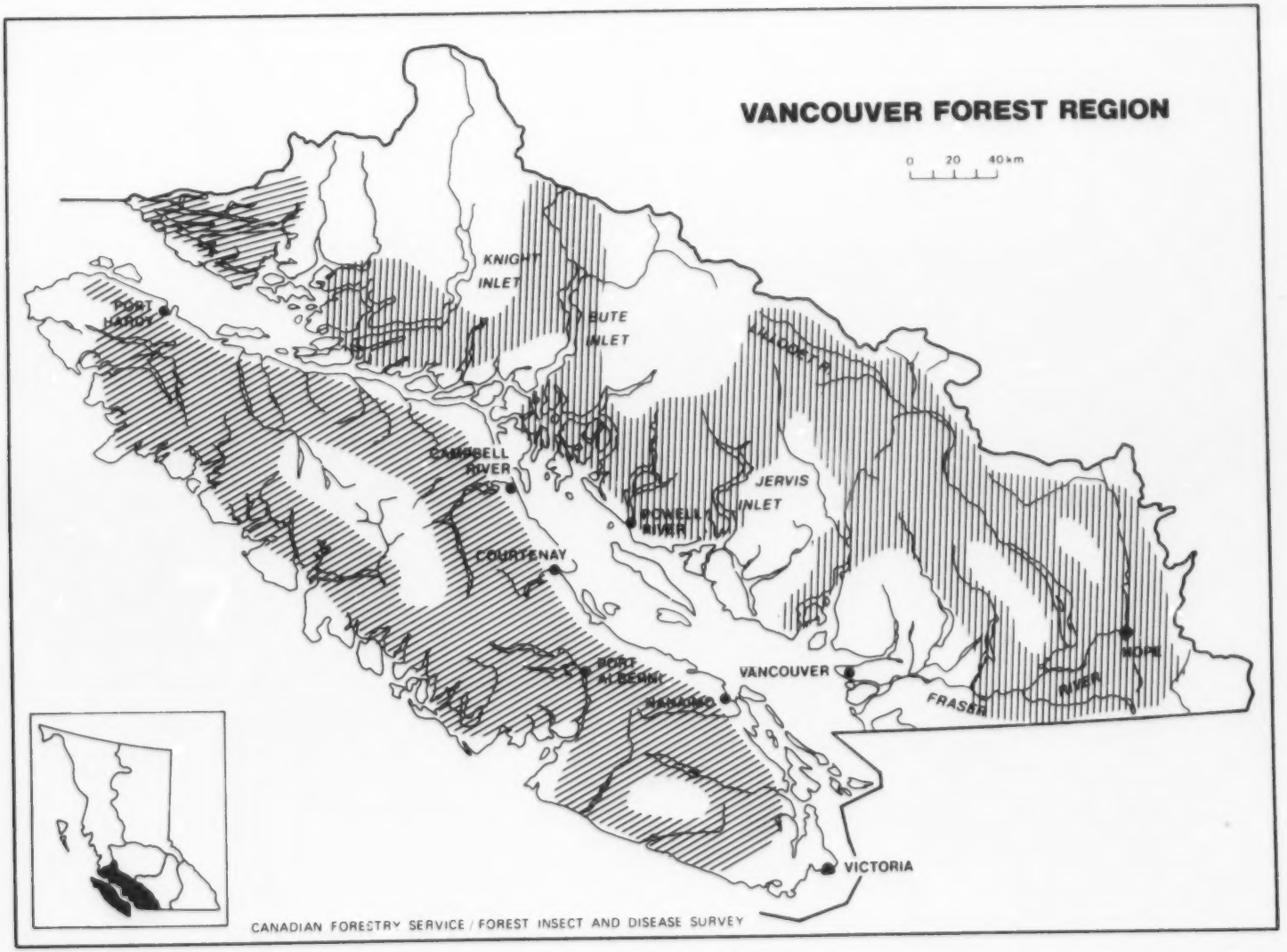
A total of 14 adult male **gypsy moths** were trapped in the Region in 1986, 8 in Chilliwack, 4 in the Victoria area and 1 each in Vancouver and Point Roberts. Defoliation by **western tent caterpillar** expanded for the fifth consecutive year in the Lower Mainland, Gulf Islands and Southern Vancouver Island.

Special surveys included: pinewood nematode collections; inspection of provincial parks and seed orchards; white pine cone crop assessments; root rot surveys and gypsy moth and clearwing moth pheromone trapping. Five **acid rain plots** were established in the Vancouver watersheds to detect and monitor early signs of acid rain, bringing the total number of plots in the Region to ten.

The forest pest survey field season extended from mid-May to late September. A total of 441 insect and 166 disease collections were submitted to PFC by FIDS survey personnel. Maps 1 and 2 show the locations where one or more samples were collected and the areas covered by 28 hours of fixed-wing aircraft surveys. A total of 78 special collections included pine leader weevil, pine needle sheathminer, mistletoe hyperparasites, cone collections, mass collections of winter moth and forest tent caterpillar.

The number of standard FIDS three-tree beating samples from all hosts which contained larvae increased to 49% from 45% in Mainland forests and decreased to 54% from 82% on Vancouver Island.

Map 1. Locations where one or more forest insect and disease samples were collected in 1986.



Map 2. Areas covered by aerial surveys to map bark beetle and defoliator infestations, 1986.

DOUGLAS-FIR PESTS

Western spruce budworm, *Choristoneura occidentalis*

The western spruce budworm defoliated 1 255 ha of mature and immature Douglas-fir in the Vancouver Region in 1986 (Map 3). This is the first time in five years that any significant defoliation has been recorded in the Region.

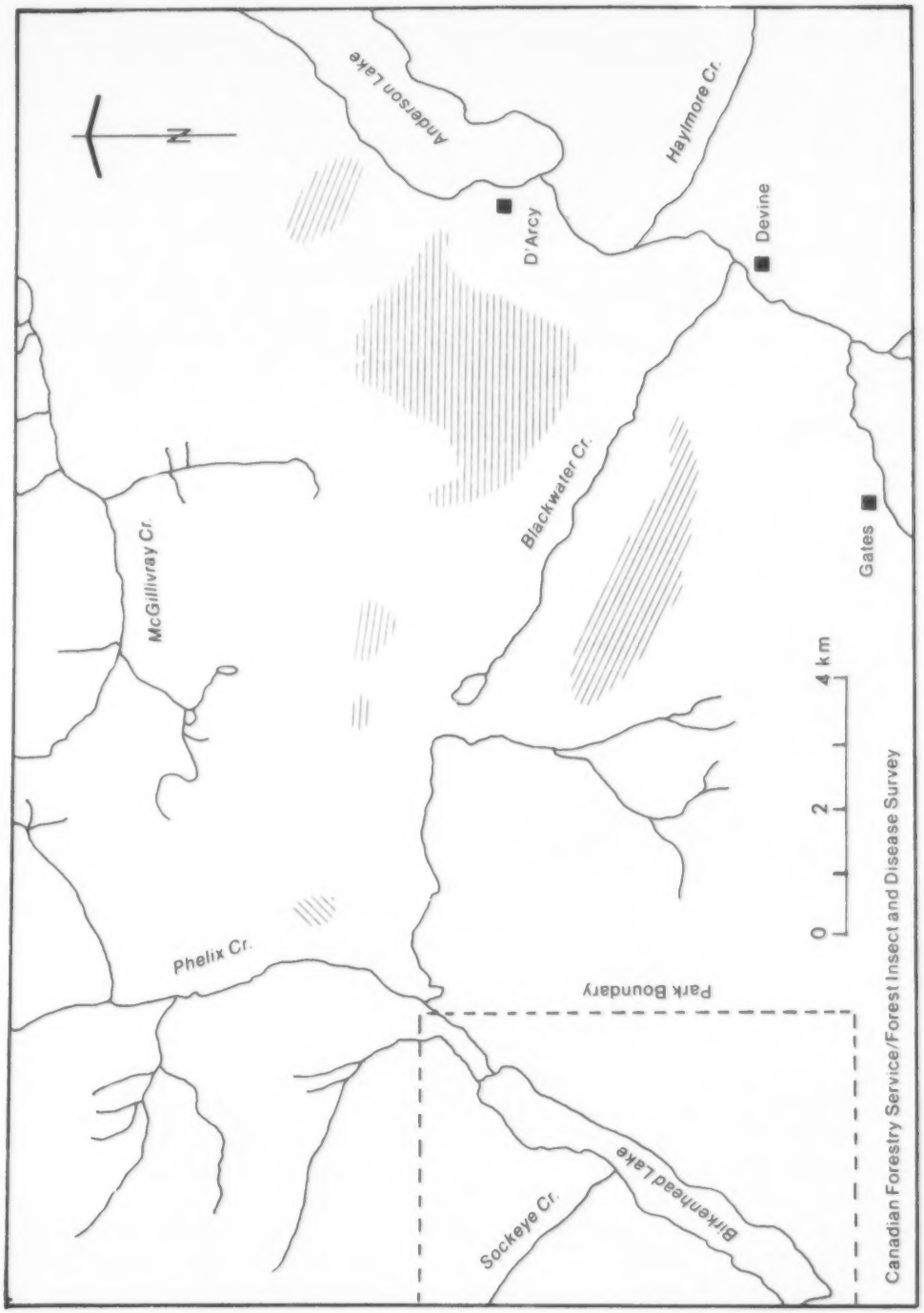
Defoliation was noted in the Blackwater and D'Arcy creek drainages, northwest of Devine and D'Arcy. The budworm caused light defoliation over 735 ha in five infestations on the north and south slopes of the Blackwater Creek Watershed (Table 1). The single infestation in the D'Arcy Creek drainage covered a total of 520 ha with 270 ha of moderate and 250 ha of light defoliation.

Table 1. Location, area and intensity of Douglas-fir defoliation by western spruce budworm as determined from aerial surveys, Vancouver Forest Region, 1986.

TSA and Location	Area of defoliation (ha)			
	Light	Moderate	Severe	Total
Soo TSA				
North Blackwater Creek	380			380
South Blackwater Creek	355			355
D'Arcy Creek	250	270		520
Total	985	270		1 255

Moderate defoliation occurred between 750 m and 1 000 m elevation, while 90% of the light defoliation was between 1000 m and 1 250 m. The Pemberton area has a history of budworm activity, with defoliation being recorded occasionally since 1943. The last recorded infestation was at Haylmore Creek, 5 km southeast of the current outbreak, in 1981.

No defoliation was recorded on Vancouver Island in 1986 and larval populations decreased. Five per cent of the Douglas-fir beating collections contained an average of two larvae/positive sample in 1986, compared to four larvae/positive sample in 1985 (Table 2). Larval numbers increased in the Mainland District; 18% of the beating collections contained larvae averaging four larvae/positive sample in 1986, compared to 8% with an average of two larvae/positive sample in 1985.



Map 3. Areas of Douglas-fir defoliated by western spruce budworm, determined by aerial surveys, Vancouver Forest Region, 1986.

Table 2. Average number of western spruce budworm larvae/positive beating sample and percent positive collections from Douglas-fir in the Vancouver Forest Region for 1984, 1985 and 1986.

Year	Avg. no. larvae/positive sample		% Positive collection	
	Van. Island	Van. Mainland	Van. Island	Van. Mainland
1984	1	1	2	14
1985	4	2	5	8
1986	1	4	5	18
Average	2	2.3	4	13.3

Egg mass collections made during September at four locations in and near the infestation area averaged 74 egg masses per 10 m^2 foliage, range 15-128 (Table 3). The number of egg masses indicates an expanding population with light to moderate defoliation expected over a larger area in 1987. The sampling method consisted of removing two mid-crown 45-cm branch sections. Egg masses were counted on each branch and extrapolated to the number of eggs per 10 m^2 of foliage; current year's egg masses are distinguished from those of previous years by being comparatively clean (opaque) and intact.

Table 3. Location, average number of western spruce budworm egg masses collected and predicted defoliation for 1987, Vancouver Forest Region, 1986.

Location	Avg. no. of egg masses/10 m^2 of foliage/plot	Predicted* defoliation
South Blackwater Cr.	128	Moderate
Devine	15	Light
Haylmore Cr.	46	Light
North Blackwater Cr.	106	Moderate

*1 to 50 egg masses/10 m^2 - light defoliation
51 to 150 " - moderate "
151+ " - severe "

Pheromone-baited sticky traps using E/Z-11-tetradecenal were placed at three locations near the infestations to determine abundance of male adults (Table 4). The trap data, although inconclusive, does indicate a potential for

the infestation to expand southeast into the Haylmore Creek drainage (117 adults) and the Devine area (64 adults) but not likely as far west as Railroad Creek (40 adults) which historically has had infestations.

Table 4. Number of adult western spruce budworm caught in pheromone-baited traps, Vancouver Mainland District, 1985 and 1986.

Location & Year	Number of adults/trap		Recorded defoliation
	Range	Average	
1985			
Powell River	39 - 59	49	None
Squamish	13 - 24	16	"
Skagit Valley	14 - 27	19	"
Range	13 - 59		
1986			
Devine	31 - 96	64	Trace
Railroad Cr.	22 - 56	40	None
Haylmore Cr.	22 -215	117	Trace
Range	22 -215		

Budworm populations are controlled periodically by natural control factors, such as weather, parasitism and disease. Population decreases are not expected in the infestation areas next year as several years are usually required before disease and/or parasitism become established. Mass larval collections will be obtained next year by CFS-FIDS personnel to monitor the incidence of disease and parasitism in the budworm population. Infested bud counts in the spring of 1987 in conjunction with mass collections will be used to predict current defoliation and populaton fluctuations.

Douglas-fir beetle, Dendroctonus pseudotsugae

Douglas-fir beetle attacks decreased for the second consecutive year in the Vancouver Region. In 1986, 55 ha of beetle-attacked trees were mapped compared with 156 ha in 1985 and 235 ha in 1984.

The decrease can be attributed in part to extensive logging of infested trees in the Ainslie Creek drainage and the large "Fra" fire west of North Bend. The 55 ha of beetle-attacked trees recorded in 1986 occurred in two infestations at Hannah Lake southwest of Lytton. The inaccessibility of the attacked trees precluded brood sampling. Beetle populations and attacks are expected to remain at low levels for 1987.

Cone and seed pests

The cone crop was generally light to medium on Vancouver Island in 1986. A total of 165 cones were collected from four locations to determine the incidence of pests (Table 5). The percentage of infested cones ranged from an average 1% (range 0-5%) attacked by the Douglas-fir cone scale midge, Contarinia washingtonensis, to 21% (range 0-60%) mined by the Douglas-fir cone gall midge, C. oregonensis. The second most abundant cone pest was the Douglas-fir seed chalcid, Megastigmus spermotrophus, which fed on an average of 20% (range 0-45%) of the cones. The Douglas-fir cone moth, Barbara colfaxiana, and the fir coneworm, Dioryctria abietivorella, both infested an average of 4% (range 0-15%) of the cones.

Table 5. Incidence of Douglas-fir cone and seed pests, Vancouver Island, Vancouver Forest Region, 1986.

% cones infested by pest	Location			
	Mt. Newton Seed Orchard	Quinsam Seed Orchard	Snowdon Seed Orchard	Gulf View Prov. Park
C. oregonensis	0	25	0	60
B. colfaxiana	0	0	15	0
D. abietivorella	10	0	5	0
M. spermotrophus	0	45	0	35
C. washingtonensis	0	5	0	0

The average percentage of cones infested has increased for all the identified cone pests except C. washingtonensis which is down to 1% in 1986 from 3.5% in 1985. The other four cone insects, C. oregonensis, B. colfaxiana, D. abietivorella and M. spermotrophus, increased to 21%, 4%, 4% and 20%, respectively, from 5.5%, 2%, 2% and 6% in 1985.

Infestations will probably continue at similar levels in 1987; this could warrant control actions in seed orchards

Swiss needle cast, Phaeocryptopus gaeumannii

Infections of this native needle disease were reduced in distribution and intensity on Vancouver Island in 1986 (Table 6). This fungus is visible on all but the current year's foliage of Douglas-fir and may result in premature needle loss.

At Snowdon Seed Orchard, needle loss per tree averaged 10% (range 0-100%), at Quinsam Seed Orchard 30% (0-100%) and at Pye Lake 10% (5-80%) of the older needles were lost. Other locations had only minor needle drop.

Table 6. Location and intensity of Swiss needle cast infections of Douglas-fir in seed orchards, Vancouver Forest Region, 1986.

Location of Seed Orchard	1985 (1984 needles)		1986 (1985 needles)	
	% of Trees	Infection* intensity	% of Trees	Infection intensity
Dewdney	100	L-S	50	L
Pacific	10	L	10	L
Tahsis	48	L	0	-
Koksilah	50	L	0	-
Harmac	30	L	0	-
Quinsam	98	L-M	4	L
Snowdon	97	M-S	1	L

*Light - 0 to 30%, Moderate - 31 to 60%, Severe - 61 to 100% of the needles infected.

Infections of Swiss needle cast decreased throughout Vancouver Island because of drier weather reducing the spread of the fungus and, in some locations, applications of fungicide. Swiss needle cast does not cause branch or tree mortality; however, repeated severe infection could result in some increment loss.

Douglas-fir growth anomalies

Growth anomalies, including twisted stems, multiple leaders without expression of dominance, crooked tops, shepherd's crook, bushy tops and occasional fasciation were noted on Vancouver Island and the Lower Mainland. These anomalies are common with an average 4% of the trees affected in some young growth Douglas-fir plantations. The cause is not known but micronutrient deficiency has been suspected. Insect or disease problems have not been associated with the anomalies. In a recent publication[1], it is suggested that deficiencies of boron and zinc may cause these growth anomalies which do not cause mortality but may cause growth loss or a degrading of the trees.

Meria needle disease, Meria laricis

This pathogen was not found in samples collected on Vancouver Island during 1986. In 1985 it was found on Douglas-fir at two seed orchards, Pacific Forest Products and Mt. Newton near Victoria. The infection rates were trace to very light.

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[1] Nutritional aspects of distorted growth in immature forest stands of southwestern coastal British Columbia by R.E. Carter, A.M. Scagel and K. Klinka published in the Canadian Journal of Forest Research Volume 16, Number 1, February 1986.

Meria is usually a disease of western larch and not usually found on Douglas-fir; it was first reported on larch in the Nelson Region in 1981. Cool damp conditions in the spring are required for spore dispersal.

Douglas-fir tussock moth, Orgyia pseudotsugata

For the third consecutive year there has been no defoliation of conifers by tussock moth in the Vancouver Region. In 1983 severe defoliation of mature and immature Douglas-fir was recorded at Chilliwack and Cassidy.

Populations are expected to remain low in 1987.

Stem canker, Nitschkia molnarii

The fungus Nitschkia molnarii Funk, in association with the insect Laspeyresia pseudotsugae, a bark miner, has moderately infected a 5-year-old Douglas-fir plantation over 300 ha on the Elk River Mainline near Campbell River. Approximately 15% (range 0-85%) of the trees in the B.C. Forest Products plantation exhibit 1- to 10-cm cankers. These cankers can produce depressions in the bark where the cambium has died without the bark sloughing off. The infected trees occur in scattered pockets often on poorly drained sites.

This fungus, N. molnarii, is rare; only one collection from a dead leader of a mature Douglas-fir at the Victoria Watershed has been recorded. The occurrence of the fungus in discreet cankers of young Douglas-fir is new. The fungus appears to have infected the tree through the superficial galleries of the bark miner; an association between the bark miner and a canker fungus, Pragmopora pithya, has previously been documented. Although the fungi P. pithya and N. molnarii are not related, they are similar because they produce multispored asci, an uncommon feature in the ascomycetes. This suggests that the spores may reproduce in a yeast-like manner, possibly on the larvae, which then spread into the bark.

Information on life cycle, preferred host or hosts and damage from N. molnarii is not available. While there is no documentation that trees under stress are more susceptible to the fungus, it is suspected that they may be.

PINE PESTS

Mountain pine beetle, Dendroctonus ponderosae

Mountain pine beetle killed an estimated 126 850 lodgepole pine over 4 160 ha in 176 infestations, a slight increase from 1985 (Table 7). The area of infestations remained relatively constant from 1985 to 1986 while the numbers of trees killed increased by 23%. Figures used in this section of the report were obtained from aerial surveys and prism plot cruising (Map 4). Four cruises were in the Pemberton-D'Arcy area and one in Manning Park.

Table 7. Location, area, number and volume of pine trees recently killed by mountain pine beetle as determined from aerial and ground surveys, Vancouver Forest Region, 1986.

TSA	Area (ha)	No. of trees killed	Volume of host killed (m^3)	No. of infestations
Fraser (including Manning Park)	190	4 850	3 880	17
Soo	1 200	58 800	47 040	111
Quadra	2 770	63 200	50 560	48
Total	4 160	126 850	101 480	176

In the Quadra TSA the volume of recently killed lodgepole pine increased by 10% to 50 560 m^3 in 1986. The area of infestations also increased, by 250 ha, to 2 770 ha. Part of this increase can be attributed to a more extensive aerial survey of the Homathko River drainage with several additional infestations being mapped farther north. The infestations are expected to decrease in area and number of trees killed in 1987 due to host depletion.

In the Soo TSA the volume of pine killed by the beetle increased by 12 140 m^3 but the actual area of infestations decreased by 230 ha. The increase in volume killed was expected as information from 1985 cruise data indicated up to a 17% increase in current attack from 1984 to 1985; the actual increase was 34%.

Beetle brood sampling at the four cruise locations indicates decreasing populations at Spetch Creek, Birkenhead Lake and Devine, with the population remaining static at King Creek (Table 8). Overwintering mortality could reduce beetle populations even further. The winter of 1985-86 reduced average brood counts per bark sample to 4.22 (range 2.25-6.75), down from 6.9 (range 3.9 - 11.5) in September 1985. The average "R" value (population predictor) in the Soo TSA in September 1986 was 2.16, indicating a decreasing population and a dramatic decrease from the 1985 "R" value of 6.9 which indicated a vigorous, expanding population. Logging in the western portion of the Blackwater Creek drainage near King Creek will further reduce beetle populations.

Map 4. Areas of lodgepole pine recently killed by mountain pine beetle, determined by aerial and ground surveys, 1986.

Table 8. "R" values and 1986 population predictions, Vancouver Forest Region, 1986.

Location	dbh(cm)	Average no. brood /225 cm^2 sample	No. galleries /sample	'R' values*	Prediction
Manning Park	(sampling not done due to MSMA application)				
King Creek	23.5	3.67	1.33	2.75	Static
Spetch Creek	(no broods)				
Birkenhead Lake	21.5	6.75	2.75	2.45	Decreasing
Devine	19.5	2.25	1.75	1.29	Decreasing
Average	21.5	4.22	1.94	2.16	

*2.5 and less = decreasing
2.6 to 4.0 = population static
4.1 plus = population increase

Current attack is down in 3 of the 4 locations cruised in the Pemberton area, with the Birkenhead Lake infestation showing the only increase, 14% in 1986 compared to 12% in 1985. At King Creek, Spetch Creek and Devine, current attack decreased from 24, 36 and 23% to 11, 0 and 5%, respectively (Table 9). The beetles in Birkenhead River drainage have moved to inaccessible higher elevation areas after depleting the host at lower elevations in the valley.

Table 9. Status of lodgepole pine in stands infested by mountain pine beetle, Vancouver Forest Region, 1986.

	Percentage of trees attacked				
Location	1986 (current)	1986 (pitchout/partial)	1985 (red)	Prior to 1985 (grey)	Healthy
Manning Park	10	4	8	9	69
King Creek	11	16	24	31	18
Spetch Creek	0	7	36	45	12
Birkenhead Lake	14	25	12	9	40
Devine	5	20	23	24	18
Regional average	8	14	21	24	32

In the Fraser TSA the volume and area of pine killed decreased by 22% to 3 880 m^3 over 190 ha (245 ha in 1985). The majority of the mortality occurred in the Upper Fraser Canyon between Yale and Keefers. Logging in the Mowhokam Creek drainage and sanitation cutting by B.C. Forest Service in conjunction with pheromone baiting in the Ainslie Creek area has reduced the infestation area and contained the beetle population.

The high number of currently attacked trees in Manning Park, 10%, up from 8% in 1985 was influenced by the use of pheromone-baited trees by the B.C. Forest Service in the Copper Creek drainage. The BCFS in Kamloops has also used MSMA to treat all currently attacked trees in the Copper Creek drainage, so no brood sampling was carried out in this area in 1986. This method of attracting and killing beetle broods should prove to be a successful method of reducing beetle populations.

The mountain pine beetle has remained a constant and major forest pest for the past 15 years in the Vancouver Forest Region. While the beetle will probably never be eradicated, it is on the decline in the Vancouver Region, at least for 1987, due to host depletion, logging, sanitation cutting and reduced beetle populations.

Pine needle sheathminer, Zelleria haimbachi

The pine needle sheathminer defoliated immature lodgpeole pine over 302 ha in six locations on the Mainland and one location on Vancouver Island (Table 10). The percentage of trees attacked ranged from 9% at Twin One Creek to 60% at Comox, average 22%. Defoliation of the current year's growth ranged from 5% at Brett and Cartmell creeks to 50% at Comox, average 16%. Infestations have been recorded in the Kamloops Region in 1951, 1956, 1957, 1961 and 1962, but this is the first time that large infestations have been recorded in the Vancouver Region.

Table 10. Location, estimated area, percent attack and percent defoliation of lodgepole pine by the pine needle sheathminer in the Vancouver Region, 1986.

Location	Area (ha)	Percentage trees attacked	Percentage defoliation
Comox	30	60	50
Twin One Cr.	19	9	20
Rogers Cr.	60	10	15
Texada Is.	18	10	10
Wilson Cr.	80	22	10
Brett Cr.	40	28	5
Cartmell Cr.	55	5	5
Total Average	302	22	16

The needle sheathminer is a pest of young trees and is not known to attack trees less than 4 years old. This native moth of young 2- and 3-needle

pines is not a rare species but it and its damage are relatively inconspicuous unless the population is large. The overwintering second instar larvae leave mined needles and move to new growth in the spring, feeding in sheaths of developing needles and causing them to turn brown and die. Pupation occurs in late June among silken webs between the bases of mined sheaths. Parasitism plays an important role in controlling populations; the most numerous Z. haimbachi parasites come from the wasp families Ichneumonidae, Braconidae and Chalcididae.

Engraver beetle, Ips pini

High populations of engraver beetles were found in 50% of the mountain pine beetle partially attacked and pitched out trees in the Birkenhead Lake area. Engraver beetles were also evident in 10% of the unsuccessful pine beetle-attacked lodgepole pine in the King Creek drainage. Strip attacks account for 10% of the total stems in the Birkenhead stand and 11% of the stand in the King Creek area.

The pine beetle-weakened trees supply the susceptible host for the engraver beetles which usually develop in windfalls and slash. Outbreaks are usually of short duration and seldom last more than one year. The populations in the Pemberton area may develop in such numbers as to attack healthy living trees.

A dwarf mistletoe, Arceuthobium tsugense

This mistletoe, A. tsugense, severely infected shore pine over 20 ha in the Cape Lazo area of Comox. Twenty 40-60-year-old felled pine were examined and 100% of the trees were severely infected, with mistletoe shoots visible on an average of 70% of the branches and stems, range 30-100%. Through the use of a 6 class rating system for dwarf mistletoe intensity and a growth loss equation, an estimated annual 40% growth loss occurred in the infected trees. Clear-cutting the infected stand would be the only effective method of controlling the spread of this parasitic plant.

European pine shoot moth, Rhyacionia buoliana

Pine shoot moth is an introduced pest of exotic and ornamental pines that was first found in Victoria in 1927. Minor damage to Mugho and other ornamental pines continued on Southern Vancouver Island in 1986, with light bud mining occurring at the University of Victoria and Wintergreen Tree Farm near Mill Bay.

Shoot moths and associated damage have not been recorded in native lodgepole pine stands in B.C. This pest is expected to persist in ornamental pines on Southern Vancouver Island in 1987.

Pinewood nematode, Bursaphelenchus xylophilus

Quarantine-related surveys in the Vancouver Region to determine the presence of nematode consisted of stem disk and chip sampling of lodgepole and western white pines (Map 5). Twenty-seven areas where visibly weakened pine occurred were sampled, of which one tested positive for Bursaphelenchus sp. The positive sample was taken from lodgepole pine in the Qualicum Beach area

Map 5. Locations where one or more pinewood nematode samples were collected, 1986.

and is undergoing further identification in Ottawa to determine if it is B. xylophilus or a native species.

The possibility of export restrictions, due to this pest, of all coniferous raw materials necessitates data collection to obtain the required phytosanitary certificate and will continue in 1987. The pinewood nematode was responsible for mortality of pines over large areas in Japan during the past three decades.

HEMLOCK PESTS

Western blackheaded budworm, Acleris gloverana

The blackheaded budworm infestation in the Statlu Creek drainage collapsed in 1986 as expected. This pest lightly defoliated 2 000 ha of western and mountain hemlock in 1985. Egg sampling in the winter of 1985 indicated trace defoliation for 1986 (Table 11). Endemic low level populations were located in the area in 1986 but there was only minor bud damage, <2% buds attacked. To provide additional confirmation of the endemic population, egg sampling was carried out again in 1986; however, no eggs were found at any of the locations sampled, indicating even lower populations in 1987. From the larvae collected this year, 11% were found to be parasitized by Diptera (flies) and 11% by Hymenoptera (wasps). Populations are expected to remain low in 1987.

Table 11. Location and average number of healthy blackheaded budworm eggs for 1985 and 1986 and predicted defoliation for 1986 and 1987, based on twenty 45-cm branch samples per location, Vancouver Forest Region, 1986.

Location	Avg. no. of healthy eggs/branch		Predicted defoliation*	
	1985	1986	1986	1987
South Statlu Cr.	1.25	.0	Trace	None
Blacklock Cr.	2.15	.0	Trace	None
Tessaro Cr.	1.15	.0	Trace	None
Chehalis R.	1.35		Trace	
Dunsmuir Cr.		0.9		None
Port Renfrew		0.5		None
Marshall Cr.		1.7		Trace
Gracie L.		1.9		Trace

*Trace defoliation: 1- 5 healthy eggs/45-cm branch
Light " : 6-25 "
Moderate " : 26-59 "
Severe " : 60+ "

Four locations were sampled on Vancouver Island for blackheaded budworm eggs. Egg counts were low, ranging from an average of 0.5/branch at Port Renfrew to 1.9 at Gracie Lake near Port Alberni.

Western hemlock looper, *Lambdina f. lugubrosa*

Populations of hemlock looper declined slightly in the Vancouver Region in 1986 (Table 12). Only two larvae were found in 84 collections from western hemlock, compared with four larvae in 62 collections in 1985.

Table 12. Percentage of western hemlock collections containing western hemlock looper and average number of larvae per positive sample, Vancouver Forest Region, 1982-86.

Year	Percentage of collections containing larvae	Average number of larvae per positive sample
1982	30	9.0
1983	34	2.5
1984	5	2.0
1985	6	1.0
1986	2	1.0
Average	15	3.0

The last outbreak occurred in 1971 at Coquitlam Lake, and populations are expected to remain low in 1987.

Green-striped forest looper, *Melanolophia imitata*

Green-striped forest looper populations have remained at trace levels for the third consecutive year. In 1986 4% of western hemlock and 5% of Douglas-fir beating collections contained larvae compared with 21% and 35% in 1985 (Table 13). The average number of larvae per positive beating sample increased slightly on western hemlock from 2 in 1985 to 2.3 in 1986 but decreased from 3 to 1 on Douglas-fir.

Table 13. Percentage of western hemlock and Douglas-fir collections containing green-striped forest looper and average number of larvae per positive sample, Vancouver Forest Region, 1984-86.

Year	Percentage of collections containing larvae		Average number of larvae per positive sample	
	wH	D-fir	wH	D-fir
1984	18	27	2.0	2.6
1985	21	35	2.0	3.0
1986	4	5	2.3	1.0
Average	14	22	2.1	2.2

Populations are expected to remain low in 1987 although past infestations have been characterized by rapid increases.

Phantom hemlock looper, Nepytia phantasmaria

For the second consecutive year, the phantom hemlock looper has not been collected in the Vancouver Forest Region. In 1984, 2% of collections from western hemlock contained an average of 1 larva. The phantom hemlock looper severely defoliated western hemlock at Coquitlam Lake in 1982.

Brown crumbly rot, Fomes pinicola

A light infection of brown crumbly rot was found in a mature stand of mountain hemlock at Mt. Washington on Vancouver Island when a survey using the line intersect method showed 4% of the trees were infected. This fungus is usually a decayer of slash and dead trees but is found occasionally on dead portions of living trees indicating considerable decay. This decay is widespread throughout the Region on many species of trees.

Hemlock twig dieback, Sirococcus strobilinus

This leaf and shoot blight has caused widespread light dieback of western hemlock regeneration throughout the University of British Columbia Research Forest. The dieback affected branch tips of 2- to 20-cm and resulted in needle loss and twig mortality. The most severe damage occurred on 5-10-year old understory hemlock along the E20 road, infecting 60% of the trees and killing an average of 10% of the new shoots over an estimated 10 hectares.

Growth loss results from continued defoliation but no tree mortality has been recorded.

TRUE FIR PESTS

Western balsam bark beetle complex, Dryocoetes confusus
Ceratocystis dryocoetidis

This insect-disease complex killed high-elevation alpine fir over 240 ha in the Vancouver Region in 1986, down from 380 ha in 1985 (Table 14). The dead trees were located in the Mowhokam, Joffre and Kookipi creek drainages covering 80, 45 and 115 hectares, respectively. The Mowhokam and Kookipi creeks are located in the Upper Fraser Canyon and Joffre Creek flows into the north end of Lillooet Lake.

Table 14. Location, area, number and volume of balsam trees recently killed by western balsam bark beetle complex determined from aerial surveys, Vancouver Forest Region, 1986.

Location	Area (ha) and severity			Number of trees killed	Volume of host killed (m^3)
	Light	Moderate	Severe		
Mowhokam Cr.	20	45	15	3 000	3 200
Joffre Cr.	35		10	1 400	1 500
Kookipi Cr.			115	10 300	11 000
Total	55	45	140	14 700	15 700

The insect occurs throughout the interior of British Columbia, mainly on alpine fir, although amabilis fir may be attacked. Western balsam bark beetles attack the stem of the tree and, in association with the lesion-causing fungus, Ceratocystis dryocoetidis, kill the cambium. Control at present is not feasible, although salvage logging of infestations will reduce actual timber loss.

Balsam woolly aphid, Adelges piceae

Balsam woolly aphid was found in four of five areas surveyed in 1986. Samples were positive at Dewdney Seed Orchard and CIP Seed Orchard, both near Victoria, Yellow Point Seed Orchard near Nanaimo and Fleet Main near Lake Cowichan. All the positive collections were found within the known infestation area. A survey at Mt. Washington was negative.

The most severe damage occurred at Fleet Main where twigs and branches on 5% of the trees were moderately gouted. Only trace damage was visible at Dewdney, Yellow Point and CIP seed orchards.

A collection by the B.C. Forest Service of balsam in Westview near Powell River was positive for woolly aphid. This location is within the BWA regulation area but outside of the BWA infestation zone. British Columbia Forest Products personnel collected woolly aphid-infested amabilis fir branches on West Thurlow Island near Campbell River. This location is well out of both the known infestation zone and regulation area.

Surveys will continue in 1987 to monitor the spread of this pest.

Fir needle rust, Pucciniastrum epilobii

This yellow needle rust severely infected 5-20-year-old amabilis fir over 50 ha at the head of Mosquito Creek west of Harrison Lake. Approximately 50% of the current foliage (range 20-100%) on 90% of the amabilis fir was affected. The younger trees (under 3 m) were the most severely damaged with

80-100% of the foliage infected, while the upper third of the taller trees (over 4 m) remained free of rust. The reason for the greater rate of infection of the shorter trees is that the alternate host, fireweed, Epilobium angustifolium, grows only to a height of 1-2 m. This rust is capable of causing mortality of seedlings and very young trees; however, none is expected for 1987.

SPRUCE PESTS

Spruce beetle, Dendroctonus rufipennis

Spruce beetle killed an estimated 8 000 m^3 of Sitka spruce over 327 ha on Vancouver Mainland in 1986. In 1985, 233 ha of beetle-killed spruce were mapped in the same area. The nine infestations occurred in the Smokehouse Creek drainage 50 km south of Rivers Inlet. The increase can be attributed to more extensive aerial coverage. The beetle population is expected to remain at the same endemic level for 1987, mainly due to lack of suitable host.

Spruce aphid, Elatobium abietinum

Spruce aphid populations were low with only occasional trace defoliation on Sitka and ornamental spruce on Vancouver Island. The population ranges from Victoria to Port Hardy on the east coast and Port Renfrew to Tofino on the west coast.

No insects were found at the 5 locations surveyed; however, damage was identified in Victoria at Lost Lake Seed Orchard where 10% of the Sitka spruce were lightly defoliated. Cold winter and spring weather may reduce populations of the aphid. Surveys will continue in 1987.

Spruce budmoth, Zeiraphera spp.

Populations declined to endemic levels along the southwest and west coasts of Vancouver Island. Budmoth defoliation causes browning of the new flush on Sitka spruce. No defoliation was recorded in 1986. The species of budmoth previously identified as causing damage are Zeiraphera vancouverana and Z. unfortunana collected near Jordan River in 1985. The survey for the budmoth will continue in 1987.

CEDAR PESTS

Western cedar borer, Trachykele blondeli

This common woodborer of western red cedar attacked an estimated 4% of the semimature and mature cedar over 100 ha, 5 km north of the North Bend airport. The percentage of attacked trees may be higher, as the borer can attack living western red cedar without visibly injuring or killing the tree. Infested trees are readily determined once they have been felled and limbed, as the larval tunnels are exposed in the knot face. Direct control of the borer is difficult, since the larvae are mostly found in the heartwood. Burning slash would kill any adults or pupae left in the debris on site and would reduce the breeding population attacking trees along the margin of the logged area.

Cedar leaf blight, Didymascella thujina

Discoloration of immature and semimature western red cedar occurred in most areas of the Vancouver Region where dense cedar stands occur. The foliage of affected trees, especially the lower branches, turns reddish brown in the spring, then grey. In the fall, infected leaf twigs drop leaving the branches bare. Damage is rarely serious in forest stands, but this fungus can be a problem of seedlings.

MULTIPLE HOST PESTS

Young stand surveys

A total of 16 stands of natural and planted regeneration were examined for pest problems in 1986 (Table 15). Major pests included: Cooley spruce gall aphid on Douglas-fir and spruce; needle sheathminer on lodgepole pine; fir needle rust on amabilis fir; twig blight on western hemlock and deer browse and climatic damage, common on most species.

Monitoring of pest problems in young stands will continue in 1987.

Table 15. Pests of young stands, Vancouver Forest Region, 1986.

Location	Host	Age	Stand type	No. trees examined	% trees affected	Pest present	Intensity
Gibson Pass	lP	15	natural	50	5	Pissodes terminalis	Light
Mowhokam Cr.	lP	8	natural	110	5	Synanthedon sequoiae	Light
Cogburn Cr.	wH	5	natural	69	-	-	-
	alF			23	17	Acleris gloverana	Light
	wC			11	-	-	-
	D	8	planted	74	11	Zeiraphera sp.	Light
					100	Adelges cooleyi	Light to moderate
North Bend (airport)	lP	12	natural	100	100	Endocronartium harknessii	Severe
					4	S. sequoiae	Light
Brett Cr.	lP	15	natural	40	4	S. sequoiae	Light
Emory Cr.	D	3	planted	100	6	Drought	Mortality
Twin One Cr.	lP	5	natural	92	19	Zelleria haimbachi	Light

Location	Host	Age	Stand type	No. trees examined	No. trees affected	Pest present	Intensity
Roger Cr.	lP	7	natural	102	60	Zelleria haimbachi	Light
Texada Is.	lP	5	natural	70	18	"	"
Wilson Cr.	lP	10	natural	50	80	"	Moderate
Brett Cr.	lP	10	natural	50	40	"	"
Cartmell Cr.	lP	5	natural	100	55	"	"
U.B.C. Research Forest	wH	10	natural	100	60	Sirococcus strobilinus	Light
Mosquito Cr.	aF	10	natural	42	90	Pucciniastrum epilobii	Severe
	wH			71	-	-	-
Gold River	D	7	natural	14	90	A. cooleyi	Light
	wH			37	6	Deer browse	Light
					14	Chlorosis	Light
Mt. Washington	aF	5	natural	81	83	Frost damage	Light
	sS			12	-	-	-
	yC			15	-	-	-

aF amabilis fir
D Douglas-fir
sS Sitka spruce
yC yellow cedar
wH western hemlock
wC western red cedar
lP lodgepole pine
alF alpine fir

Climatic damage

Adverse weather conditions in 1985, i.e. the long dry summer and the unseasonable cold November, contributed to widespread dieback and mortality of several tree species in the Vancouver Region in 1986. Abiotic stress damage was reported from the Gulf Islands to Pemberton and included balsam, pine, cedar and Douglas-fir.

On Sidney Island in TFL 71 an estimated 120 immature and semimature grand fir and western red cedar died from climatic stress. No disease or insect pests were present in trees sampled on the island. Relatively shallow topsoil (0.5 to 1.0 m) on a heavy clay soil with poor moisture retention was a factor in the mortality. Douglas-fir trees on the island were not affected.

On Vancouver Island, dead tops (0.5 to 2.0 m) on immature and mature Douglas-fir were prevalent from Campbell River to Victoria. Examination of 5

top-killed semimature Douglas-fir in the Coombs area found no evidence of insect or disease damage. The same injury with 0.5 m to 1.0 m of top-kill was recorded on immature Douglas-fir in the Chilliwack Lake area on the Mainland. In the Pemberton area widespread scattered mortality of immature and semimature Douglas-fir and lodgepole pine was evident on south-facing slopes.

Laminated root rot, Phellinus weirii

Approximately 500 Douglas-fir trees were killed over 75 ha by laminated root rot in the Vancouver Forest Region in 1986. The mortality occurred in three areas along the Fraser River between Boston Bar and Hope. This is a reduction of nearly 50% from 1985. The actual P. weirii-infected area has not been reduced but the total area mapped was less due to the lack of Douglas-fir beetle attack in the stressed trees. In the Fraser Canyon, Douglas-fir beetle attacks mainly P. weirii-infected trees, turning the trees a very visible red and outlining the root rot pockets.

On Vancouver Island, no root rot areas were visible during aerial surveys but ground surveys using the line intersect method show laminated root rot in 10% of the mature Douglas-fir in Miracle Beach Provincial Park. Light to moderate infections of laminated root rot were recorded in western hemlock stands at five locations on Vancouver Island with intensities ranging from 10 to 21% (Table 16).

Table 16. Locations, intensity and percentage of western hemlock infected by laminated root rot on Vancouver Island, 1986.

Location	Species	% trees infected	Infection intensity*
Woss	wH	10	light
Roberts Lake	wH	21	moderate
Nimpkish River	wH	10	light
Muchalet Lake	wH	11	moderate
Port Alice	wH	12	moderate

*Light 0-10%; moderate 11-30%; severe 31-100%.

Laminated root rot infected 10% of the trees in two western hemlock stands at Woss and the Nimpkish River north of Woss. Near Port Alice, 12% of the western hemlock in one stand is infected.

At Roberts Lake north of Campbell River, 21% of the trees surveyed were infected and at Muchalet Lake north of Gold River, 11% of the trees were infected. This root rot is widespread throughout the Region, resulting in significant annual volume loss.

Cooley spruce gall aphid, Adelges cooleyi

This phylloxerid was widespread in the Region in 1986 throughout most of the range of its hosts, Douglas-fir and Engelmann, Sitka and white spruce. The presence of the white cottony tufts on Douglas-fir were recorded in twelve seed orchards surveyed in the Region, discoloring 10-100% of the new foliage. The cone-shaped galls on spruce twigs were present in 75% of the seed orchards on 10-48% of the spruce. The galls are only considered to be important on seedlings and saplings in nurseries and plantations.

Root-collar weevil, Steremnius carinatus

Damage by this pest of recently planted seedlings continued in 1986. Surveys by Western Forest Products personnel near Holberg on Northern Vancouver Island indicates a decline in mortality from previous years. On Southern Vancouver Island damage continued at levels similar to 1985. Mortality in new plantations on the Island is expected to continue in 1987. The adults girdle 1- and 2-year-old seedlings at the ground line; Douglas-fir and Sitka spruce are preferred but hemlock and true fir are also attacked.

DECIDUOUS AND ORNAMENTAL TREE PESTS

Gypsy moth, Lymantria dispar

Agriculture Canada trapped 8 adult male gypsy moths in 8 traps at Chilliwack, 3 in 2 traps at Colwood and 1 each at Vancouver and Point Roberts (Table 17). At Goldstream Provincial Park, 1 moth was caught in 1 trap by the B.C. Forest Service. In addition, 7 females, 2 complete and 5 partial egg masses were found at Chilliwack. The finds at Chilliwack were all within a 60 m radius of the 1986 Bacillus thuringiensis spray zone, except for 1 male which was trapped 3 km from the core area.

Table 17. Locations where adult male gypsy moths were trapped in sticky traps baited with sex pheromones in the Vancouver Region, 1986.

Location	No. of adults trapped	No. of traps
Belmont Park (Colwood)	3	2
Chilliwack	8	8
Goldstream Park	1	1
Point Roberts	1	1
Vancouver	1	1
TOTAL	14	13

The Canadian Forestry Service placed a total of 88 gypsy moth pheromone traps in the Vancouver Region, all of which were negative (Map 6). Egg mass

Map 6 Locations of pheromone-baited gypsy moth traps placed by CFS-FIDS, 1986.

searches in the multiple catch sites at Chilliwack and Colwood should be completed by the end of November. Eradication programs through the use of sprays have been planned for the Chilliwack site in 1987. The pathogen B. thuringiensis will be applied by 3 aerial and 3 ground sprays in May and June. In addition, 2 ground sprays of carbaryl will be applied to trees in the vicinity of the moth catches.

Pheromone trapping programs are expected to continue in 1987.

Western tent caterpillar, Malacosoma c. pluviale

Western tent caterpillar defoliation expanded for the fifth consecutive year in the Vancouver Region. On Vancouver Island tent caterpillar caused light to severe defoliation of roadside deciduous trees, shrubs, fruit trees and alder in forest stands. The defoliation extended in patches from Campbell River to Victoria along the east coast of the Island and the Gulf Islands. The most severe defoliation was from Nanaimo south to Victoria and the Gulf Islands, including Galiano Island.

Light to severe defoliation of deciduous trees and shrubs was common in the Lower Mainland from Ladner to Abbotsford and north to Horseshoe Bay. Moderate defoliation of red alder was common from Gibsons Landing to Powell River including Bowen and Texada islands.

At Victoria, dead larvae were found in some locations; a viral infection is suspected and samples are being analyzed. Egg samples at Victoria found a ratio of 1 new to 6 old egg masses, indicating a decline in population for 1987 (Table 18). At Sidney Spit Provincial Park on Sidney Island the ratio was 1 new to 2 old egg masses, indicating a slight decline in population. However, it is expected that potentially annoying numbers of tent caterpillar will be present in 1987, based on the number of egg masses found (2.3 new, 4.3 old per tree). Along Herd and Osborne roads and at the Crofton Ferry near Duncan, the ratios of new to old, at 1:1, 1:1 and 1:2, respectively, indicate a static population with continued defoliation in 1987.

Table 18. Location, number and ratio of new and old western tent caterpillar egg masses and defoliation forecast for 1987, Vancouver Forest Region, 1986.

Location	DBH (cm)	No. new egg* masses per tree	No. old egg masses per tree	Ratio	
Victoria	5	0.4	2.4	1:6	Decrease
Sidney Island	-	2.3	4.3	1:2	"
Herd Road	5	3.4	2.8	1:1	Static
Osborne Road	2	1.2	1.5	1:1	"
Crofton Ferry	4	4.4	2.6	2:1	Increase
Average	4	2.3	2.7	1:1	

*Based on 10 branches per tree on 5 or 10 trees per site (depending on availability), sampled in October, 1986.

Barring climatic-caused reductions or extensive parasitism, defoliation should be similar to 1986 in all areas except Victoria, where populations may start declining. Tree mortality is not usually associated with this pest and trees attacked usually refoliate the same year.

Winter moth, Operophtera brumata

Winter moth defoliation continued for the sixteenth consecutive year at low levels similar to 1985, in the Greater Victoria, Colwood and Saanich Peninsula areas. Defoliation of primarily Garry oak, broadleaf maple and fruit trees was generally trace to light in patches. There was no visible defoliation at Duncan, Saltspring Island or Nanaimo where larvae were collected in 1985.

Between 1979 and 1982, a parasite release program by the Canadian Forestry Service in Greater Victoria released 30 000 larval parasites. Cyzenis albicans and Agrypon flaveolatum are now established in infested stands, causing a significant decline in winter moth populations. Parasitism averaged 44% in both 1984 and 1985. Larval parasitism is being evaluated for 1986 and results should be available in early 1987. Pheromone trapping for adult male moths is planned for late November from Victoria to Nanaimo, similar to 1985.

Aspen leafminer, Phyllocnistis populiella

This leafminer caused moderate defoliation of immature and mature black cottonwood over 200 ha between Cheakamus Lake and Highway 99. Normally this transcontinental pest attacks only trembling aspen. Growth reduction will occur as could mortality with repeated attacks.

Western oak looper, Lambdina f. somniaria

Populations remained low at Mt. Maxwell Ecological Reserve on Saltspring Island after the infestation collapsed in 1985. Defoliation occurred the 5 previous years with 16 ha defoliated in 1984. There were no western oak loopers in beating samples in 1986. Population collapse is usually the result of parasitism and viral infection. Defoliation by western oak looper does not cause tree mortality as refoliation the same summer is usual.

Cypress tip moth, Argyresthia cupressella

For the eleventh consecutive year, tip moth continued to be active in southwestern B.C. on ornamental juniper and cedar. In 1986, widespread foliage damage and occasional branch and shrub mortality occurred, similar to 1985.

Light to moderate discoloration of cupressaceous trees and shrubs such as Italian, Leyland, Lawson and Monterey cypresses, oriental cedar and some species of juniper occurred in the spring of 1986 from Esquimalt to the Saanich Peninsula, including Victoria. Light discoloration and occasional branch dieback continued at Duncan, Nanaimo, Comox-Courtenay, Campbell River and in urban areas of the Lower Mainland.

Infestations will likely continue in 1987 with damage similar to 1986. A systemic insecticide applied in March and April and again at egg hatch in July could be effective in reducing damage and controlling high populations.

Fall webworm, Hyphantria cunea

Populations of this colonial defoliator declined to endemic levels on Vancouver Island and remained at 1985 levels on the Mainland. Webs were common on alder, willow and cottonwood during September in the Chilliwack-Agassiz area. Control of this pest is seldom necessary because the damage is generally of aesthetic rather than economic importance.

Arbutus leaf spot

Leaf spot occurred from Victoria to Nanaimo including the Gulf Islands. The diseases affected 30% (range 0-50%) of the foliage on 90% of the trees on Saltspring Island, 20% (0-50%) of the foliage on 60% of the trees in Greater Victoria and 10% (0-50%) of the foliage on 90% of the trees at Duncan.

Leaf spot is caused by four fungi: Didymosporium arbuticola; Diplodia maculata which causes small spots; Coccomyces quadratus; and Rhytisma arbuti, which cause large black "tar spots". These four species attack only arbutus and may occur singly or together. Spores are usually spread during winter rains so removal of fallen foliage will help reduce infection.

Leaf spot is expected to continue in 1987 with damage similar to 1986.

Brown rot, Monilinia sp.

Widespread discoloration and shrivelling of the leaves of fruit trees occurred in the Fraser Valley in the spring and summer of 1986. The main hosts are drupaceous species of which wild and cultivated cherries were the most severely infected with 100% defoliation of single trees being common. Apple and plum trees were also affected to a lesser extent. The first spring infection is caused by spores from conidial tufts and/or apothecia from the blighted fruit of previous seasons which have fallen to the ground. Rainy periods in the spring with relatively low temperatures are conducive to the spread of the rot.

Broadleaf maple dieback

Broadleaf maple dieback occurred on scattered roadside trees along the east coast of Vancouver Island from Victoria to Campbell River, and on the Gulf Islands. The most severe damage occurred between Victoria and Comox where 30% (range 0-90%) of the foliage on 20% of the broadleaf maple was affected.

It is unclear what causes the dieback. Some samples were infected by Phomopsis sp., a disease that causes damage to new stems, but this pathogen has not been associated with 90% of the locations sampled. Damage will be surveyed in 1987 and samples analyzed.

Dogwood leaf blight, Gloeosporium sp.

The incidence of infection by this blight remained at the same levels as 1985 after two years of decrease. Light to severe defoliation occurred from Peace Arch Park to Powell River and east to Harrison Lake and on Southern Vancouver Island.

Infections were generally moderate on the Mainland and restricted to the lower crowns of the affected trees. Branch dieback is more prevalent this year due to the accumulated effect of annual infection. The incidence of leaf infection averaged 25% at Harrison Lake, range 10-90%, and 20% at Sechelt, range 10-40%. Branch dieback ranged from an average of 10% on infected trees at Sechelt to 30% at Harrison Lake.

On Southern Vancouver Island infections were light to severe, predominantly on the lower crown of scattered dogwoods. At Gulf View Provincial Park, CIP Seed Orchard near Victoria and Sproat Lake Provincial Park, 95% of the foliage on one tree, 30% on two trees and 90% on five trees, respectively, was affected.

Moist spring weather will facilitate continued infections in 1987.

SPECIAL SURVEYS

Seed Orchards

The twelve seed orchards in the Vancouver Region were surveyed 21 times throughout the field season for early detection of pests, damage assessments and discussion of management options. Surveys resulted in over twenty pests recorded, of which nine can be considered significant (Table 19). The most serious are the five cone and seed pests, Contarinia oregonensis, Megastigmus spermotrophus, C. washingtonensis, Barbara colfaxiana and Dioryctria abietivorella, which caused light to severe damage of the cones on 5-45% of the Douglas-fir in Mt. Newton, Quinsam and Snowdon seed orchards. Cooley spruce gall aphid, Adelges cooleyi, discoloured needles on 25-90% of the trees in the seed orchards which stocked Douglas-fir. Galls were formed on 20-48% of the spruce twigs by the same pest in 75% of the spruce orchards surveyed. Balsam woolly aphid, Adelges piceae, was present in 5% of the balsam in Dewdney, C.I.P. and Yellow Point seed orchards. Douglas-fir twig beetle, Pityophthorus pseudotsugae, caused light twig mortality on 2, 40 and 72% of the Douglas-fir in Koksilah, Quinsam and Snowdon seed orchards, respectively.

Table 19. Pests of Seed Orchards, Vancouver Forest Region, 1986.

Seed Orchard	Host[1]	Pest	Intensity[2]	% Trees Affected
VANCOUVER ISLAND				
Dewdney	D-fir	Cooley spruce gall aphid	light	90
		Swiss needle cast	moderate	50
		Silver spotted tiger moth	light	1
	Ba	Balsam woolly aphid	light	4
Mt. Newton	D-fir	Cooley spruce gall aphid	light	80
		Dioryctria abietivorella	moderate	10
C.I.P.	D-fir	Cooley spruce gall aphid	light	50
	Ba	Balsam woolly aphid	light	5
	sS	Cooley spruce gall aphid	light	35

Seed Orchard	Host[1]	Pest	Intensity[2]	% Trees Affected
Lost Lake	sS	Cooley spruce gall aphid	light	48
		Spruce aphid	moderate	20
Cobble Hill	sS	Cooley spruce gall aphid	light	20
		Spider mites	light	5
Koksilah	D-fir	Cooley spruce gall aphid	light	90
		Douglas-fir twig beetle	light	2
Yellow Point	sS	Spider mites	light	10
	Ba	Balsam woolly aphid	light	4
Harmac	D-fir	Cooley spruce gall aphid	light	80
Quinsam	D-fir	Cooley spruce gall aphid	light	56
		Swiss needle cast	light	4
		Contarinia oregonensis	moderate	25
		Megastigmus spermotrophus	severe	45
		Contarinia washingtonensis	light	5
		Douglas-fir twig beetle	light	40
Snowdon	D-fir	Rhabdocline needle cast	light	3
		Swiss needle cast	light	1
		Barbara colfaxiana	moderate	15
		Dioryctria abietivorella	moderate	5
		Cooley spruce gall aphid	light	30
		Douglas-fir twig beetle	light	72
VANCOUVER MAINLAND				
Sechelt	wH	Tent caterpillar	light	1
		Sirococcus strobilinus	light	3
	D-fir	Cooley spruce gall aphid	moderate	80
		Sunscald	light	3
Surrey	D-fir	Cooley spruce gall aphid	severe	82
		Orange tortrix	light	8

[1] Ba Balsam
D-fir Douglas-fir
sS Sitka spruce
wH western hemlock

[2] light - small populations/light infection/little or no damage
moderate - moderate populations/moderate infection/some damage or loss
severe - large populations/severe infection/serious loss or potential loss - action indicated

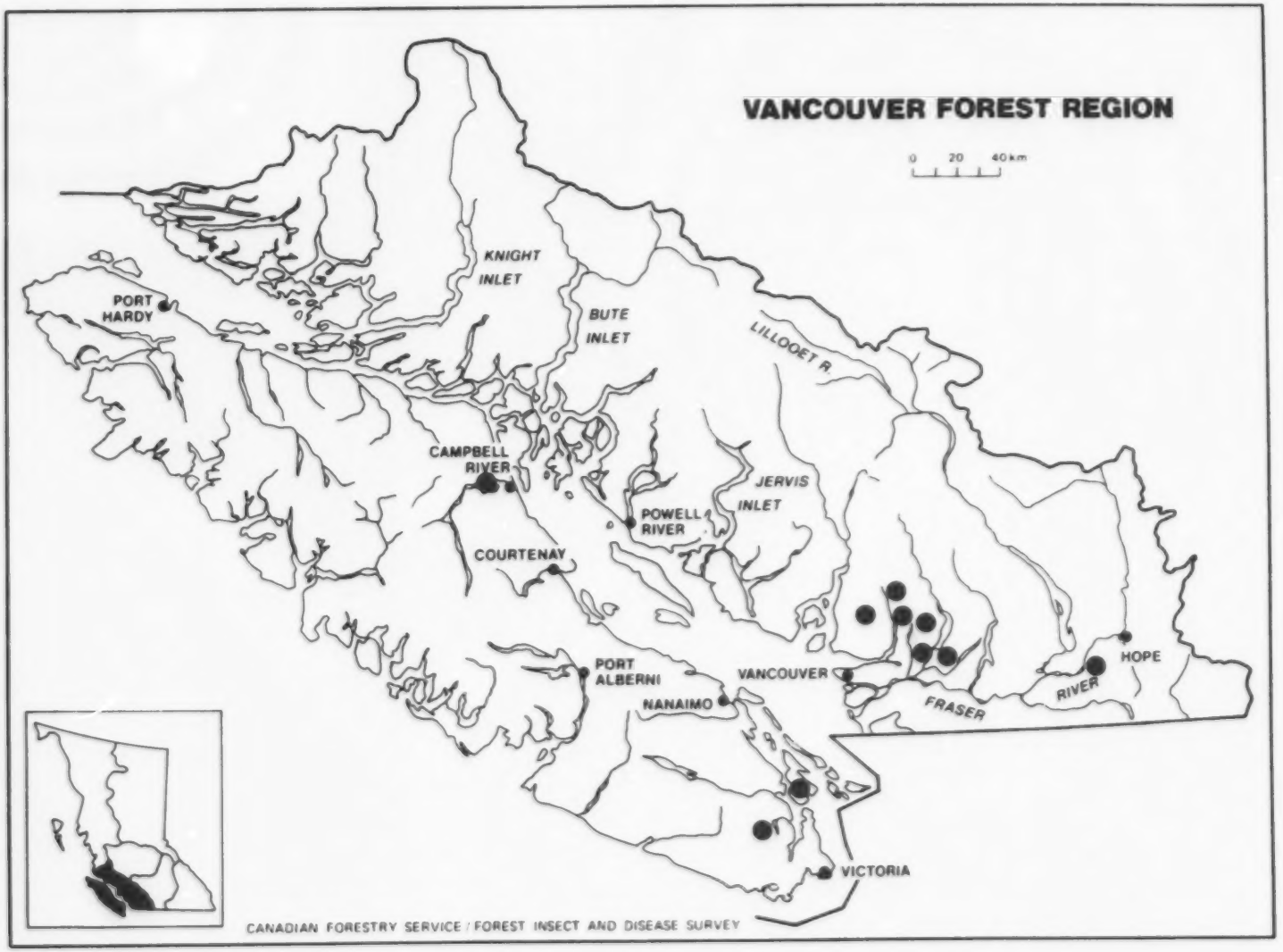
Fume damage, sulphur dioxide

Damage suspected to be caused by sulphur dioxide was recorded near Port Alice on Vancouver Island. Approximately 240 ha were mapped during aerial survey on the hillside behind the pulp mill. An estimated 90% of the foliage on 90% of the western hemlock were severely affected. The symptoms include a reduction in needle length (30% less) and only 4 years average needle retention. The 1986 needles are in the best condition with each preceding year showing more chlorosis and needle drop. The trunks of the trees are abnormally clean, with a scrubbed look that is believed to be caused by high atmospheric sulphur dioxide concentrations. Lichens and liverworts are absent indicating higher than normal levels of acidity in the atmosphere. Red alder, maple and salmonberry in the northern half of the affected area exhibited interveinal necrosis and chlorosis. The damage to the deciduous species is suspected to be caused by 1986 emissions, while the damage to the conifers is thought to be cumulative (the mill has been operating for over 60 years). CFS-FIDS will continue monitoring the fume damage site and north along the Neroutsos Inlet where wind may influence deposition to determine short- and long-term impact.

Acid rain plots

Five additional ARNEWS (Acid Rain National Early Warning System) study plots were established in the Vancouver Region in 1986. The five new plots were located on the north shore of Vancouver, 1 in Capilano, 2 in Seymour and 2 in the Coquitlam watersheds (Map 7).

These plots are part of a national system to gather baseline data on acid rain in Canada's forests. The data is needed to clearly and accurately detect early signs of acid rain damage and to annually monitor for changes in forest soil, vegetation and trees which may be related to acidification of precipitation, fog or clouds or other atmospheric pollutants.



Map 7. Location of ARNEWS plots, (Acid Rain National Early Warning System), 1986.

Clearwing moths, Sesiidae

Pheromone trapping for these moths for taxonomic purposes consisted of 1 multipher trap at each of 4 locations on both Vancouver Island and the Mainland. The traps were placed out in May and retrieved in September. The adults trapped were collected weekly and sent to Biosystematics in Ottawa for identification. Results from the trapping are pending. Clearwing moths include the sequoia pitch moth, Synanthedon sequoiae, a pest of pines in British Columbia.

Forest Pests in Provincial Parks

Forest pests were recorded in 31 of 65 parks examined in the Region in 1986, as part of an ongoing cooperative interagency program.

Mountain pine beetle, Dendroctonus ponderosae, was the most damaging pest, killing lodgepole pine over 90 ha in Birkenhead Park and over 20 ha in Manning Park along Copper Creek. Western spruce budworm, Choristoneura occidentalis, while not recorded in any parks in 1986 will probably spread to Birkenhead Park in 1987 from the neighbouring infestations in the Blackwater Creek drainages.

Western tent caterpillar, Malacosoma californicum pluviale, was widespread in the Region in 1986 and defoliated various deciduous trees in the following parks: Ruckle, Sidney Spit, Apodaco, Porteau Cove, Shannon Falls and Peace Arch.

Aspen leafminer, Phyllocnistis populiella, moderately defoliated black cottonwood over 200 ha at Garibaldi and Cheakamus Lake parks.

The leafroller, Archips rosanus, was active in red alder at Deer Lake, Emory Creek, Kawkawa and Silver Lake parks.

As previously mentioned, gypsy moth traps were placed in 53 Provincial Parks by CFS-FIDS in the Vancouver Region. There were no moths caught in these traps, but B.C. Forest Service did trap one male adult in Goldstream Park on Vancouver Island. Gypsy moth pheromone trapping will continue in 1987 at Provincial Parks.